CALIFORNIA ENERGY COMMISSION
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September 20, 2002

SUPPLEMENT TO THE FINAL STAFF ASSESSMENT – PART 3

MORRO BAY POWER PLANT (00-AFC-12)

Enclosed is Energy Commission staff's assessment of Duke Energy's Habitat Enchancement Program (HEP) proposal for its proposed Morro Bay Power Plant Project (MBPP). This document is a supplement to staff's Aquatic Biological Resources assessment that was issued as a section of staff's Final Staff Assessment (FSA), Part 3, of April 25, 2002.

Any questions or comments regarding this supplement, the HEP supplement, or the project should be addressed to Marc Pryor, the Energy Commission project manager at (916) 653-0159, at mpryor@energy.state.ca.us, or at the address above.

The Energy Commission's MBPP Committee has scheduled an evidentiary hearing on October 17, 2002, in Morro Bay to hear testimony on Duke's HEP proposal. Agencies wishing to comment on this testimony or on Duke's HEP proposal are encouraged to submit their comments to the MBPP Committee by October 7, 2002, the deadline established by the Committee for other parties to file testimony on the HEP proposal. Members of the public wishing to comment may do so at the Committee hearing on the matter.

Information and some documents regarding the MBPP are available on the Energy Commission's website at http://www.energy.ca.gov/sitingcases/morrobay; the Committee's Hearing Order can be found at http://www.energy.ca.gov/sitingcases/morrobay/notices.

Enclosures: Aquatic Biological Resources- Supplement
Declarations and Resumes of new staff witnesses

AQUATIC BIOLOGICAL RESOURCES- SUPPLEMENT (MARINE AND ESTUARINE RESOURCES)

Testimony of Andrea Erichsen, Richard Anderson, Michael Foster, Ph.D., and Bruce Barnett, Ph.D., with Appendix A by Richard Ambrose, Ph.D.

INTRODUCTION

This document completes the California Energy Commission staff's assessment of Aquatic Biological Resources, and is provided as a supplement to the Final Staff Assessment, Part 3 (FSA Part 3). The FSA Part 3 filed in April 2002, contains staff's assessment of the proposed project's impacts to marine and estuarine biological resources. In the FSA Part 3, staff recommended the project not be approved using once-through cooling due to significant adverse impacts. The FSA Part 3 also stated that the Applicant's proposal for mitigation for aquatic impacts that had been recently filed lacked sufficient detail for staff's evaluation at the time.

This document presents staff's analysis of the Habitat Enhancement Program (HEP) proposed by Duke Energy North America, LLC, (Duke) for the Morro Bay Power Plant Modernization Project (MBPP). The Applicant's HEP proposal was first submitted to the California Energy Commission on July 1, 2002 (DUKE 2002HEP_a).

Staff and the intervenor Coastal Alliance on Plant Expansion (CAPE) issued data requests (Staff 2002HEP_Dreq, CAPE 2002HEP_a) on July 15, 2002. On August 30, 2002 the Applicant provided data responses along with the revised HEP document (citation). A data response workshop was held on September 10, 2002, in Morro Bay. In this supplemental testimony, staff examines the scope, relevance, adequacy, and scientific basis of the proposed HEP as well as factors concerning potential implementation, monitoring needs, and compliance with applicable laws, ordinances and standards (LORS). The LORS relevant to evaluating the HEP are summarized in the FSA Part 3, and so this testimony does not repeat the LORS information.

Staff's analysis in this supplemental testimony focuses on the HEP proposed by the Applicant. As the Applicant noted in their proposal, the Applicant has used a different methodology for translating the entrainment impacts of the proposed MBPP to acres of bay habitat that would be restored than the Central Coast Regional Water Quality Control Board (Regional Board) staff has used in recent reports the Regional Board. Energy Commission staff has not addressed the Regional Board staff's approach in this testimony. While the two approaches differ in some key aspects, Energy Commission staff believe that the same types of adjustments and refinements identified below for the Applicant's proposal would apply if the Regional Board and Energy Commission decided to move forward with the Regional Board staff's approach.

BACKGROUND

Part 3 of the FSA provides staff's analysis of the impacts of the proposed MBPP to marine and estuarine resources. The Applicant proposes to use the existing cooling water intake system (CWIS) thus continuing once-through cooling in Morro Bay. This

requires Energy Commission approval as well as a National Pollution Discharge and Elimination System Permit (NPDES) issued by the Regional Board, and compliance with provisions of the Clean Water Act (CWA).

Staff used the biological studies required under sections 316(a) and 316(b) of the Clean Water Act, to conduct the analysis required pursuant to the California Environmental Quality Act (CEQA). These studies provided quantitative impact data on larval entrainment, impingement, and thermal discharge to natural aquatic communities. Based upon these data, staff concluded that the CWIS would result in significant adverse biological impacts due to the proportional entrainment of 17 to 33 percent of fish and invertebrate larvae. The impingement of fish and invertebrates and the alteration of marine communities by thermal discharge are two additional adverse impacts caused by once-through cooling to Morro Bay and Estero Bay. In the FSA Part 3, staff recommended avoiding these significant adverse impacts by eliminating or significantly reducing the use of once-through cooling, and implementing alternative cooling technologies, such as dry cooling. Staff continues to recommend avoiding these significant once-through cooling impacts that would continue for the next 30 to 50 years.[1]

The Applicant has maintained in its testimony that the project will not result in any significant impacts to the marine biological resources of Morro Bay, and that alternative cooling technologies are not feasible. On this basis, the Applicant has suggested that the HEP proposal be considered and evaluated as a voluntary mitigation, and not as mitigation required under California Environmental Quality Act (CEQA) to reduce the significant impacts that would result from the continued use of once-through cooling. As described above, staff has presented testimony supporting its conclusion that the project will result in significant impacts under CEQA. The hearing record on this question has been closed, with the record remaining open solely to consider Applicant's HEP proposal.[2]

In the Hearing Order on the review of the HEP, the Committee in this case noted that the "Applicant's proposals may also be evaluated as mitigation of a significant environmental impact under the California Environmental Quality Act (CEQA), the Committee expects the parties to examine Applicant's proposals according to the standards and guidelines of CEQA." The Committee further noted that an adequate HEP should include, at a minimum:

[1] Staff understands that under CEQA, the Energy Commission is directed to evaluate the "Change" in the environment, and that staff and the Applicant adopted different positions about what the baseline conditions – to which the change is compared – should be. On August 30, the Committee issued an Order stating that the baseline is the amount of cooling water used by the existing project averaged over the five years 1996-2000. Staff respectfully disagrees with the Committee's ruling, but notes that the proposed new flow of the plant (475 mgd) still represents a 23% increase over the Committee's identified baseline of 387 mgd.

[2] The Committee's order also directed the parties to thoroughly review the pilot aquatic filter barrier (AFB) proposal from the Applicant. As discussed further below, in its filings, the Applicant has stated that it is only seeking to study the feasibility of a pilot AFB, and is not actually proposing to implement a pilot program. Therefore, there is no pilot AFB proposal for staff to consider at this time.

1. a description of a HEP which is adequate to actually compensate for the environmental impact, is feasible, as defined by CEQA Guidelines (section 15364), and which meets constitutional requirements for nexus and proportionality;
2. identification of the goals and objectives to be achieved by the HEP;
3. performance standards for accomplishing the goals and objectives;
4. identification of how the HEP will be fully enforceable through permits conditions, agreements, or other measures to ensure that identified mitigation projects will be carried out;
5. a reporting and monitoring program to ensure that specific elements of the HEP are implemented, that performance standards are met, that responsibilities are assigned, that monitoring activities are scheduled, and that any needed corrections to the plan can be taken in a timely way;
6. contingency plans to be implemented if a specific project has not or is not likely to meet its objectives, or if a project is found to be more successful than anticipated;
7. substantiated cost estimates and an enforceable payment schedule.

Consistent with the Committee's order and with staff's conclusion that the project as proposed will result in a significant adverse impact, staff is assessing the potential for this type of mitigation to comply with the CEQA as well as section 316(b) of the Clean Water Act.

The Applicant's HEP has been proposed as a voluntary mitigation to reduce the significant impacts that would result from the continued use of once-through cooling. Staff has been instructed to evaluate the proposed HEPs applicability and adequacy to mitigate for the proposed MBPP's biological impacts. Staff is also assessing the potential for this type of mitigation to comply with the California Environmental Quality Act (CEQA) and the Clean Water Act (316b).

THE APPLICANT'S PROPOSED HABITAT ENHANCEMENT PROGRAM

In this section staff will summarize the major characteristics of the proposed HEP and the reader is referred to the DUKE 2002HEP_b, the August 30, 2002 HEP document for complete details.

OBJECTIVES OF THE PROPOSED HEP

The Applicant's HEP has four main objectives as stated on page 2 of the DUKE 2002HEP_b, HEP document:

1. Offset and minimize the effects of entrainment of the modernized plant;
2. Improve the quality and quantity of aquatic habitat in Morro Bay;
3. Reduce sediment transport into Morro Bay; and
4. Complement ongoing Bay protection and enhancement programs overseen by the Regional Board, the Morro Bay National Estuary Program (MBNEP), and the Army Corps of Engineers (ACOE).

The Applicant proposes that the administration of the HEP would be conducted through a non-profit organization (the Administrative NGO) comprised of a specially appointed Executive Board. This Executive Board would consist of representatives of the Regional Board, the Energy Commission, the MBNEP, the City of Morro Bay, and other selected agencies.

The HEP would be funded through a guaranteed $12.5 million of funding not to be increased or reduced by performance adjustment mechanisms (DUKE 2002HEP_b, page 5; see also section 7.6.1 of the HEP).

BUILDING BLOCKS OF THE PROPOSED HEP

The Applicant proposes five "building blocks" for the HEP (DUKE 2002HEP_b, HEP page 5, and data response to Energy Commission staff page 3). These "building blocks" were originally outlined in Attachment A to Duke's May 23, 2002 letter to the Regional Board, but have been further refined (see responses to Energy Commission data request).

The proposed project building blocks have been proposed as follows:

Block #1: Design features of the modernized plant

Block #2: Permit flow restrictions

Block #3: Implementation of representative habitat enhancement projects

Block #4: Aquatic Filter Barrier (AFB) feasibility study

Block #5: Safety factors and credit considerations

The "core" building block for the Applicant's HEP proposal is Block #3. Blocks 1, 2, and 4 are not relevant to this assessment.

REPRESENTATIVE PROJECTS

Block #3 is the core of the habitat enhancement plan which consists of a set of representative habitat enhancement projects that were developed using the Habitat Equivalency Analysis (HEA) model (discussed below). Section 5 of the HEP document provides some details for the representative projects.

Representative projects were selected based upon many factors including: proposed nexus to MBPP entrainment effects, location, cost effectiveness, ability to measure performance, basic need or justification for project, technical feasibility, nature and extent of ecological benefits, length of time before benefits accrue, opportunities for leveraging of funds, availability of matching funds, success of comparable restoration projects, stakeholder acceptance, likely duration of benefits, consistency with ongoing work of the Regional Board, MBNEP and ACOE, legal hurdles (e.g., permits, legal access), implementation costs, and administrative considerations (DUKE 2002HEP_b, HEP page 31).

The Applicant developed three representative restoration projects and three sediment control projects based, in part, on an assumption that the species that are entrained by

the plant are not limited by the number of larvae available, but rather by the quality and quantity of habitat available for their settlement, recruitment, and survival as adults. This assumption is carried over in the HEA model that will be discussed in a later section of this analysis.

The representative projects were designed according to two basic strategies:

a. There are three projects that directly restore in-bay habitat:
   - hoary cress removal
   - sandspit stabilization to protect eelgrass
   - eelgrass restoration, and

b. There are three projects that slow sedimentation as a result of watershed management:
   - Chorro Flats II
   - Hollister Ranch, and
   - Cal/Poly/Walter's Ranch

Section 5 of DUKE 2002HEP_b provides more detail on each project. Staff analyzed the goals, restoration methods, schedule, and cost/benefits of these projects in the section below based upon their presentation in the HEP as "representative" projects, not actual projects that will, in fact, be implemented. In addition, these representative projects are based on assumptions that do not provide any level of certainty that the projects will be successful. Staff does not necessarily agree with all of the assumptions made (discussed below).

THE AQUATIC FILTER BARRIER (AFB)

An AFB is a form of physical barrier (usually a fine mat or mesh) which prevents larval and larger forms of marine life from being entrained into the cooling water intake structure. Refer to the FSA Part 3 Appendix A for staff's analysis of AFB technology and its applicability to the proposed MBPP. As part of the HEP, the Applicant has proposed to study the feasibility of installing a pilot-scale AFB in Morro Bay near the MBPP's intake structure. The Applicant stated that it is not seeking conditions of certification approving or relating to the physical installation of a pilot-scale AFB at this time. The Applicant is interested in AFB technology because it has the potential to reduce entrainment. The Applicant's proposed feasibility study would include:

1. A review of AFB technology as applied in Morro Bay;
2. An analysis of the commercial requirements and economic viability for such a project (e.g., local land use entitlements); and
3. An evaluation of the governmental permits that would need to be obtained, including the timing and complexity of those permit processes.

Upon completion of the feasibility study, the Applicant would determine whether to initiate a permitting process for a pilot-scale AFB, and would consult with the Energy Commission, the Regional Board, the COE, and other resource and regulatory agencies as appropriate.

Staff is not evaluating this aspect of the HEP package because there is nothing to evaluate at this time. The applicant is not seeking a permit condition from the Energy Commission that would allow deployment of the AFB. Moreover, as stated in the FSA Part 3, Appendix A analysis and based on comments from other agencies, the AFB is presently considered an experimental technology. Despite its potential for use in the future, the AFB does not currently meet staff criteria for mitigation. If the Applicant intends to pursue the separate AFB feasibility study after certification, an amendment and proposal will need to be submitted to Energy Commission staff for review.

STAFF'S EVALUATION OF THE PROPOSED HABITAT ENHANCEMENT PROGRAM

Staff's evaluation of the proposed HEP, submitted on August 30, 2002 addressed a number issues, including the strength of the nexus between the impacts and the mitigation, the appropriateness of using the HEA model (which was developed to deal with oil spills and other short-term environmental disasters), and the ability of the Energy Commission and other resource agencies to measure the results of the mitigation actions and to adjust the mitigation to ensure success over the life of the project. Practical considerations in terms of funding, implementation, monitoring, and governance are also evaluated.

Staff has used the following questions to evaluate the HEP proposal:

1. Does the HEP address regulatory issues? (Section 2, Appendix C)
2. Does the HEP identify an appropriate nexus between the entrainment impacts caused by the project and the ecological responses derived from the HEP? (Section 3)
3. Are the HEP objectives consistent with the identified nexus? (Section 3)
4. Are the desired ecological responses of the HEP clear and measurable? (Section 3)
5. What is the HEP model used to develop the projects? (Section 4, Appendix D) and are the model assumptions, input, and output clear and correct? (Section 4)
6. Are the designs of the proposed projects based on the best available science and are they technologically feasible? (Section 5, Appendix E, Appendix F, Appendix G, Appendices I and J)
7. Does the HEP propose sufficient monitoring? (Section 3, Pages 31-34, Appendix B)
8. Does the HEP provide sufficient criteria for determining global and project specific success? (Section 3, pages 41-45)
9. Is there sufficient explanation and consideration of an adaptive management strategy? (Section 3)
10. Is the HEP implementation plan sufficient? (Section 5)

11. Does the HEP provide adequate contingency plans? (Section 3.4, 3.6)
12. Are the HEP funding amount and implementation schedule sufficient? (Section 7)
13. Is the HEP governance structure acceptable? (Section 8)

Staff provides point by point discussion of the above topics in the following sections. Staff also examined available data in the Applicant's data responses to Energy Commission staff and CAPE. A data response workshop was held on September 10, 2002. Staff and other parties asked clarifying questions of the Applicant at the data response workshop, and some useful information was discussed.

1) THE PROPOSED HEP AND REGULATORY ISSUES

The legal framework of the proposed HEP is presented in Section 2 and Appendix C. The HEP addresses relevant regulatory issues, however, under the Applicant's proposal, once the funds have been provided, the Applicant's legal obligations cease. Given the uncertainty associated with the actual success of the HEP in increasing larval production, as well as the fact that the HEP must provide benefits to account for 50 years of operation, staff is concerned about the applicant's lack of responsibility for the long-term success of HEP projects.

CEQA requires that a Lead Agency approving a project that will cause significant adverse environmental impacts implement a monitoring program to ensure compliance with mitigation measures "during project implementation", which in this case is 50 years (Public Resources Code ξ21081.6).

The Applicant states that the HEP exceeds the U.S. Environmental Protection Agency (EPA) proposed requirement that they reduce entrainment effects by 60-90 percent. The Applicant maintains that their HEP will achieve a 100 percent reduction by habitat restoration alone. Yet, the HEP neither provides support for the 100 percent figure, nor does it sufficiently propose how it will monitor the resources involved to determine that this level of mitigation has been achieved and maintained. While staff supports this reduction goal as an ideal, staff reasons that it will be difficult to meet this goal at 100 percent. Regardless of whether the reduction goal is set to a more realistic level such as 60 percent, staff asserts that more definitive performance criteria and monitoring plans would be required to substantiate the goal.

The Applicant also briefly discusses the role of CEQA in its discussion of the legal framework. As noted above, the Applicant has testified that the project will not have any significant impacts on marine biological resources because the Applicant is prepared to accept a cap on annual water use that is below the historic baseline. For this reason, the Applicant argues that mitigation is not required under CEQA. Staff disagrees with this conclusion, based on the fact that biological activity, such as spawning and other life-cycle events, varies significantly over time in an unpredictable manner in Morro Bay, as can be seen from a review of the Applicant's 316(b) monitoring results (need citation). Staff believes that this variability, which may result in increased numbers of larvae and vulnerable organisms being entrained during long periods of high water use, makes it impossible to demonstrate that a reduction in long-term average water use will reliably result in reduced biological impacts. Staff recognizes that the hearing record is

closed on this question, but raises the point here because this unresolved dispute over the CEQA impacts from the project directly affect the regulatory framework for evaluating the Applicant's proposed mitigation measures.

2) THE NEXUS OF THE PROPOSED HEP

The nexus is staff's starting point for evaluating the proposed HEP. The HEP is predicated on the assumption that restoration, enhancement, and/or preservation of habitat in Morro Bay will increase biological production in Morro Bay and thereby compensate for entrainment losses associated with operation of the modernized MBPP. The Applicant's proposed nexus is stated in the HEP Section 3, page 27 and is related to human-accelerated sedimentation and it's effects on productivity in the Morro Bay. Sedimentation is a significant problem affecting the water quality and habitat availability in Morro Bay and causes the loss of estuarine habitat used by fish and invertebrates to reproduce and survive. Specifically, the Applicant hypothesizes that the ongoing loss of habitat due to sedimentation decreases larval production in numerous species Ultimately, larger-scale effects may occur in the estuarine ecosystem because the larvae are an important part of the food web of Morro Bay. The MBPP's CWIS also results in a loss of larvae via entrainment. The Applicant therefore proposes that entrainment mortality may be mitigated by increasing larval productivity in the estuary by reducing sedimentation.

Indeed a major assumption of this approach is that so long as suitable habitat exists, the existing reproductive capacity of the species in question is sufficient to ensure that those habitats will be fully occupied. Staff does not fully agree with this assumption because there are other factors (natural and anthropogenic) affecting fish and invertebrate populations in the bay. Additionally, the HEP model is not based on empirical data collected from Morro Bay. Based upon this assumption, the Applicant argues that restoration or enhancement of degraded habitats will provide new opportunities to these species, and biological production will increase as a direct result. This linkage is the Applicant's nexus between the entrainment mortality caused by the cooling water intake structure and the proposed HEP. However, reducing sedimentation does not create habitat, it slows sedimentation effects (which cover and modify habitats) on the estuary. The power plant is not known to cause sedimentation.

Furthermore, the Applicant does not establish this the nexus by comparing by larval mortality due to the power plant to increases in larval production accruing from the HEP. Instead, the HEP relies upon a disaster-response model developed by the National Oceanic and Atmospheric Administration's (NOAA) mitigation model, biomass calculations, and a specific assumption that it is habitat, not the number of larvae or other environmental factors, that limits the affected populations. Indeed, while the 316(b) study measured the impacts to larvae, there are no population trends or empirical data for the affected fish species in Morro Bay. The Applicant acknowledges these limitations by incorporating 'conservative' assumptions and by proposing limited baseline monitoring. While we have empirical data to support the conclusion that sedimentation is one component affecting the structure, size, and perhaps ecological health of the Morro Bay ecosystem, we really do not know how other stressors, such as non-point source pollution and bacteria and invasive species, are affecting fish and invertebrate productivity (of larvae), alone or in combination. As a result habitat

restoration may result in a fraction of the intended benefits that would accrue in a more pristine environment (not accounting for inherent ecological dynamics of estuarine ecosystems).

Staff asserts that a critical nexus both can and should be measured. This nexus should be increases in larval production of those species impacted by the CWIS. If the Energy Commission approves the HEP as mitigation, it should require that the Applicant actually measure and monitor the fish and invertebrate larvae that will be increased as a direct result of its actions, as well as, how much this increase in productivity offsets the losses caused by the CWIS. If the initial projects do not succeed, the Applicant should be required to undertake additional projects or actions to achieve effective and sustained increases in larval productivity that truly offset the ongoing impacts caused by the CWIS. This would result in a nexus that is more tightly couple the mitigated impacts with the actual mitigation.

3) HEP OBJECTIVES

Because the HEP will neither eliminate nor avoid the adverse impacts of the CWIS, it should contain appropriate measures and measurable success criteria that will identify whether the HEP provides compensation for the quantified losses in biological production associated with cooling water withdrawal. In Section 3 of the HEP, the Applicant develops the HEP's objectives based upon their stated nexus:

1. Offset and minimize the effects of entrainment of the modernized plant;
2. Improve the quality and quantity of aquatic habitat in Morro Bay;
3. Reduce sediment transport into Morro Bay; and
4. Complement ongoing Bay protection and enhancement programs overseen by the Regional Board, the MBNEP, and the ACOE.

Staff agrees that these general objectives are appropriate for the HEP. However, staff recommends refining the nexus, developing realistic and measurable goals for restoration projects, and providing funding levels based on the above objectives.

4) DESIRED ECOLOGICAL RESPONSES OF THE PROPOSED HEP

The Applicant states that "the success of the HEP will be measured by a combination of project-level success factors and global performance metrics. Project-level success factors include specific performance criteria and monitoring requirements that will be developed during the design and planning stage of a particular project, when the detailed information needed to complete these tasks is available" (DUKE 2002HEP_b, page3). Staff disagrees with this approach, and believes that additional performance criteria must be developed to evaluate the success of the overall HEP in mitigating the impacts of the once-through cooling system proposed for MBPP.

Staff does support the Applicant's efforts to assure that the individual projects and the entire HEP would be based upon project-level and global performance criteria in order to achieve success. However, staff is not clear as to the value of "global performance metrics" because each HEP restoration project would require project-specific success criteria and performance criteria.

While the Applicant has provided several representative projects, staff has determined that the desired ecological responses need to be more carefully defined to reflect the desired ecological responses in terms of enhanced larvae production for many affected species, in addition to responses related to increased habitat functionality, of eelgrass, saltmarsh, fringe wetlands, and mudflat. At this time, such ecological responses are not provided in sufficient detail in Section 3 or Section 5.

One realistic approach to performance criteria would be to collect data similar to that collected for the 316(b) study, every five years. This would enable agencies to determine if there is an increased number of fish and invertebrate larvae. This should not be the only measure of success, but it is a direct and more nexus-focused measure.

In addition to the fact that the actual HEP results are not well defined, staff has determined that it may be difficult to demonstrate that the derived ecological benefits will actually occur. Refer to **Appendix A** wherein Dr. Ambrose discusses how, for wetland restoration projects in general, ecological success is generally considered to have occurred if the restored wetland performs the same biological functions as a natural wetland. However, in reality has not been the observed result, as detailed in several project comparisons discussed in Ambrose (2002a). Although outright failure may be ruled out, detailed studies, including many in California, indicate that the functions that occur in natural wetlands are not duplicated by the restored sites. Compliance with permit conditions was another significant problem identified by Ambrose (2002a) and this is a serious consideration of later discussions regarding implementation, adaptive management, and contingency plans.

Staff acknowledges that effects of other activities may make it difficult to attribute precise levels of change in larval production to the HEP alone. Nonetheless, comprehensive baseline monitoring coupled with project-specific monitoring will provide much more information about the effects of the HEP than would be derived from the Applicant's proposal.

Because mitigation would not begin immediately, there would also be opportunities for more sampling before mitigation is implemented (baseline monitoring was proposed in the HEP). For example, monitoring could provide data for the two years prior to operation of the proposed new facility. This would allow for a more powerful measure of "how much have larvae increased" after the mitigation. There also may be the difficulty that some restoration projects would likely take a longer time to produce results (e.g., functionality of the habitat and sediment trapping) than the Applicant estimates. Monitoring would enable these gradual changes to be identified and quantified.

5) THE HABITAT EQUIVALENCY ANALYSIS MODEL

In Appendix A page 6 Ambrose states "The Applicant spends a good deal of time explaining the background to the Habitat Equivalency Analysis (HEA) and describing how it has been applied. They are correct in stating that HEA is used frequently by NOAA in natural resource damage assessments. However, there is a fundamental difference in how HEA is typically used by NOAA and its application by Duke. HEA is typically applied to habitat-based impacts, whereas the impacts ("debits") in Duke's

application are simply biomass, with no habitat (i.e., area) basis. This complicates the HEA, and is *not* a standard application of the method".

Staff is particularly concerned that the model and science that provides the underpinnings for the HEP are sound. While the Applicant provided information on the model and assumptions in Section 4 and Appendix D, staff did not find this information adequate for evaluation. After receiving additional clarifying information and having an opportunity to discuss the model and scientific assumptions with the Applicant during the Data Response Workshop on September 10, 2002, staff has an increased understanding of the assumptions, limitations, and strengths of the HEA model.

The HEA model balances two variables, the “debit” and the “credit” (refer to page 60 of DUKE 2002HEP_b). In developing values for each, there are numerous assumptions and constraints that are developed by the modeler and which affect the outcome and accuracy of the model. The debit is the measure of the resource loss and, in this instance, represents the reduction in the value of the water column habitat due to losses in services resulting from entrainment. The credit is a measure of the resource gained through habitat that is actively restored or through avoidance of habitat loss resulting from reduced sedimentation.

The result of the HEA model is an equation that balances the services produced by restoration projects (annual fish and crab biomass produced) with the assumed services lost (annual fish and crab biomass entrained). However, in **Appendix A**, page 2 Dr. Ambrose states "Duke’s use of a Habitat Equivalency Analysis is fundamental to its calculations of the amount of habitat enhancement needed to compensate for larval entrainment losses. HEA has been used extensively elsewhere but the appropriateness in this case is really a policy decision, especially since Duke’s losses are not habitat based even though HEA is typically applied to impacts to habitats. Like all models, HEA is dependent on the assumptions and parameter values used. Duke does not fully explain many of the critical assumptions made, and the assumptions consistently overstate the benefits of the HEP projects by underestimating the time to full productivity of a habitat, overestimating the productivity of a habitat, and overestimating the lifespan of a project".

The HEA Metric and Assumptions

The “metric” for the HEA model is commonly defined in terms of service acre-years (SAY), which is the level of services provided by the resource during one year at full services. In the MBPP’s HEP, the metric is modified to address the annual quantities of fish and crab larvae killed by the CWIS. In this HEA model, service lost/gained is therefore measured as an annual reduction in biomass (of fish and crab larvae –no other invertebrates and no specific species of fish are delineated). For the purposes of evaluating the Morro Bay HEP, it is important to recognize that this biomass metric is converted to acres of habitat to be restored. To achieve this, the Applicant uses key assumptions, many of which are not supported by empirical data or explained in detail in the proposal.

First, in terms of addressing the number of acres that would be restored, and the types and relative quantities of fish breeding habitats needing restoration, the HEP relies upon habitat mapping that is no longer accurate (DUKE 2002HEP-b, page 50). A map of

habitat distribution as determined by recent habitat surveys, was received by staff on September 6, 2002 (MBNEP 2002a, Draft Map of Morro Bay Habitat Types). This map contrasts sharply with the map provided in the HEP on page 50 in that, the former provides a distinction between high and low salt marsh (141.23 acres and 301.20 acres respectively), whereas in the more current map, there is no high/low marsh distinction (total saltmarsh 397.0 acres-which is less acreage than the 442.43 acre total provided in the HEP map). Note that Table 3, page 49 presents 295.35 acres of low saltmarsh compared to the 301.20 acres in the map on page 50. Furthermore, according to the more recent survey information contained in the MBNEP map, the eelgrass acreage (as of 2000) has increased significantly (665.8 acres) compared to 87.31 acres that indicated in Tetra Tech mapping. Taking this new mapping information into account would change the values in Table 3 (DUKE 2002HEP-b, page 49). The characterization of the relative productivity of these major habitat classifications is also somewhat arbitrary and is not supported by empirical data referenced in the scientific literature.

For example, in establishing the "credit" side of the equation, the Applicant assumed that there is a direct 1:1 relationship of habitat availability (creation of 1 acre) and its capacity to produce a constant amount of larvae (service) for all species. This assumption is very simplistic and may not be valid. The replaced habitat is currently productive habitat, so simply modifying it does not improve the ecosystem by 100 percent at that location. Staff believes the Applicant underestimates the habitat area enhanced/restored by half.

The Applicant has used the HEA model to develop each of the six projects in Appendix E. For each project, the Applicant has provided input variables and assumptions, all of which directly affect the outcome of the model. Some assumptions are conservative, some are based on government documents, while others seem arbitrary. For example, the "services" generated by a restoration project begin some time in the future when the project is complete. The services are assumed by the Applicant to increase or decrease linearly over time as the functionality of the habitat increases (e.g., vegetation grows, benthic invertebrate colonies develop, etc.). This assumes, perhaps erroneously, that the service level increases linearly and that full services are attained, independent of confounding factors.

For many of the projects, it is assumed that there will be a 0 to 100 percent success rate. A lower, more realistic success rate is preferred because the model is unrealistic, and achieving 0 percent is unacceptable, while achieving 100 percent is unlikely to happen (refer to Ambrose 2002a and **Appendix A**). It is essential that a realistic success rate should be selected for the representative projects. Staff recommends that the HEA should consult with wetland restoration specialists regarding the representative projects to determine a more realistic assumption of success rate, which may be more on the order of 60 to 75 percent.

Staff has similar concerns regarding the assumption that the 'degradation of habitat productivity' factor will be zero. This assumption is substantially oversimplified and completely removed from the real world. The Applicant seems to imply that the $2.8 million dollars provided will provide a safety margin to ensure 100 percent success. However, staff is not convinced that the funds proposed are sufficient to achieve realistic results with such unrealistic assumptions (DUKE 2002HEP_b, page 97). Staff

recommends that the HEA be based upon more realistic degradation rates, and should include ecologically relevant metrics for measuring habitat degradation should it occur (refer to Ambrose 2002a). This assumption should be derived from the literature and experiences of wetland restoration specialists.

The “debit” quantity of the HEA model was defined in the HEP as the measure of the reduction in function experienced by the affected resource from the defined time of loss to the defined time of “full recovery”. In staff’s opinion, the Applicant’s assumption of time to “full recovery” is a significant, and perhaps a spurious assumption. Full recovery is defined as the time at which the services provided by the resource return to a baseline level. Another less obvious but inherent assumption in this approach is the assumption of equilibrium in the ecosystem, an assumption that models used for restoration should make with great caution, because natural systems are not empirically known to be in equilibrium. These assumptions play a large part in shaping the HEP and should not be overlooked.

In order to calculate the debit, one must understand the baseline conditions, which in the HEP model is defined as the level of services that would have been provided in the absence of the incident over time, in this case, in the absence of once-through cooling. However, the Applicant’s proposed baseline monitoring plan is insufficient to realistically achieve a substantial level of understanding and satisfy this assumption (discussed in a following section).

The HEP proposal further assumes that biomass, while measurable, is a sufficient standard currency for determining habitat debits and credits, and for selecting restoration projects. Staff does not agree that all biomass is created equal or that biomass alone is adequate to determine mitigation effectiveness. Entrainment kills larvae of particular fish and invertebrate species, or groups of species, whereas biomass is simply the weight of organisms in the water and does not necessarily reflect losses to particular species. When asked about this issue at the September 10, 2002 workshop, the Applicant stated that its restoration proposal would result in "better" biomass, but there is no explanation as to what is "good", "bad", or "better" biomass as it relates to the estuary function, health, or community structure. An adequate HEP should include scientifically valid definitions of the basic terms used in its analysis, and should better incorporate basic considerations of ecosystem processes and community structure and dynamics into its analysis.

Ambrose (**Appendix A**) page 6 states that "On balance, Duke’s assumptions overstate the value of their projects, perhaps substantially. At the very least, Duke should perform a sensitivity analysis, showing how the range of assumptions affects the ultimate number of credits for each project. The credits Duke calculates (e.g., Table 5 in Appendix D) are only appropriate for *habitat creation* projects. For projects converting one habitat type to another (such as mudflat converted to an eelgrass bed), one must subtract the productivity of the converted habitat from the final habitat. Duke does not do this. In fact, Duke assumes that mudflat habitats have trivial production. This is incorrect. First, although attached primary producers may have low biomass, Duke has not provided any data to demonstrate that their productivity is trivial. Second, primary production by attached primary producers should not be the sole source of production allowed. Infauna in mudflats harvest energy from the water column that is then

transferred to fish biomass; this source of production is substantial and should not be ignored." Staff concurs with this opinion.

Discount Rate

Service losses from entrainment and service gains from restoration projects that occur in the future are discounted in the HEA model. Discounting (3 percent used by NOAA and DOI) accounts for the fact that restored ecological services in action today are more valuable than the unknown trajectory that will affect the level of ecological services in the future. The discount term accounts for the fact that a restoration project delayed in its inception would not be as valuable as the same project beginning today. This in itself is an assumption and staff is uncertain as to whether the 3 percent discount rate is accurate for Morro Bay. At this time staff has no evidence or reason to dispute the use of 3 percent in this model.

Lastly, because the proposed projects could have a life span of 50 to 100 years they may be affected by potential sea level rises. Staff recommends that this be addressed in the HEA model, and in subsequent development of restoration projects.

6) TECHNOLOGICAL STATUS AND FEASIBILITY OF THE REPRESENTATIVE PROJECTS

Section 5 of the proposed HEP provides a detailed discussion of the six representative projects. Refer to the testimony provided by Dr. Ambrose in **Appendix A**. On page 8 Dr. Ambrose states "Duke's confidence in the success of their proposed restoration projects is not supported by past experiences with these sorts of projects. Certainly, well-designed and funded restoration projects can provide substantial ecosystem benefits. But the literature is replete with examples of failed restoration projects, including projects that were thoughtfully planned and executed. The science of restoration ecology is young and there is much we do not know or cannot anticipate".

It appears that the strongest level of feasibility and technical reliability is provided for the sediment control and watershed protection projects presented in the Phillip Williams Associates reports (Appendices I and J). These projects generally incorporate more reliable techniques, including best management practices, however, the report and HEP lack measurable and specific goals associated with each project. In addition, these projects reduce sediment over time, which slows the decline of the estuary, but do not improve the current baseline situation.

The applied science of restoring habitats such as eelgrass and wetlands is characterized by mixed and unpredictable success. Staff recommends that the actual projects selected should be based upon empirical information (in peer-reviewed literature as well as technical reports) about the measured and realized effectiveness and difficulties of such projects. For example, although it may very well be a good and feasible project, the section on the hoary cress eradication does not provide adequate literature review and background information for staff to determine if it should be a representative project, a priority for funding, and is reasonably likely to succeed. In addition, from the data available to staff, it appears that excavating this area from its current 6+ ft. elevation to something on the order of 3 ft. would only effectively create a "detention basin" for flood overflow from Chorro Creek and would not guarantee any

effective revegetation success with either marsh species or (more appropriately) upland riparian. It may be more effective to redesign this project to retain current elevations, and replace (or allow for passive replacement of) hoary cress with native riparian (i.e. willow) vegetation. In conclusion, despite the overall ecological benefits and scientific opportunities that the restoration of habitats could potentially provide, staff has concerns regarding the level of information and related feasibility of some the representative projects.

There is evidence and discussion in the scientific literature regarding the problems and failures encountered with wetland habitat restoration for target species. For example, while the acres of wetland vegetation may be planted and may survive and occupy the target area (the assumed ecological response), the real indicator of restoration success, such as the functionality of the habitat and the long term evolutionary capacity and resilience of the restored area, may not be achieved for many years, if at all (see Ambrose 2002a and **Appendix A**). This may be attributed to a lack of understanding of the assembly rules of natural communities and the interrelated factors shaping their succession and evolution. Ecological function can be measured by species abundance and diversity, and other ecologically based criteria (please see the testimony provided by Dr. Ambrose in **Appendix A**).

Although the timeframe for achieving true ecological function and successful restoration may be longer than predicted, thus requiring a more adaptive management approach. The caveats and shortcomings of ecological restoration must be considered when planning projects and when developing measures and contingency plans (Ambrose 2002a).

7) MONITORING PLANS OF THE PROPOSED HEP

The monitoring program is an essential component of the HEP. The Applicant provides a proposal for baseline monitoring (Appendix B, and page 34 of the HEP document) as well as monitoring of restoration project progress and success (DUKE 2002HEP_b, Section 3.3.3, pages 31-34). Staff supports the use of adaptive management for implementing and evaluating the course of baseline and project monitoring plans. Staff's current evaluation concludes that both the baseline and the project monitoring are insufficient and the total funding ($165K) proposed by the Applicant is inadequate

Baseline Monitoring in Morro Bay

The Applicant is proposing to implement a baseline monitoring program in Morro Bay, as outlined in the HEP Appendix B. The purpose of the baseline monitoring is to enhance the existing MBNEP program and provide resource managers with the necessary information for monitoring the progress of the HEP projects. The list of physical and chemical water quality parameters and various remote sensing and habitat evaluation techniques proposed to monitor habitat changes both before, during, and after the HEP projects are inadequate (refer to the comments of Dr. Ambrose in **Appendix A**).

The Applicant claims that proposed fish monitoring will provide information on one of the biological communities most affected by MBPP cooling water withdrawal. However, the fish baseline monitoring plan is not adequately described, nor does it appear to have

sufficient funding in order to collect useful data. The Applicant proposes that the cost of this monitoring program will not exceed $165,000 over five-years. However, the MBPP would operate for 30 to 50 years or more. The Applicant goes on to state that "of this $165,000, no more than $8,000/year is allocated to the monitoring of invertebrates and fish" with no explanation or reasoning provided. The real cost of monitoring the baseline populations of fish and invertebrates impacted by the CWIS would likely cost significantly more than $8,000. Based upon the Applicant's present description and intent of the baseline monitoring program, staff concludes that the funding level for the baseline monitoring falls far short, especially as related to the monitoring of populations of fish and invertebrates.

Staff recommends contribution to a periodic (i.e. every 5 years) habitat mapping effort of the bay/estuary, to be conducted in cooperation with the MBNEP. The most current maps indicate how habitat size and distribution changes (sometimes drastically – i.e. eelgrass) from one year to the next and this would help the HEP projects adaptively manage the projects.

In Appendix A, page 8, Dr. Ambrose provides the following discussion, "There have been a number of reviews of wetland restoration, including several conducted by the National Research Council (NRC), and the universal recommendation is that project objectives be clearly stated, appropriate performance standards established, and project development *must be monitored* to determine if the performance standards have been met. Duke explicitly rejects this procedure (e.g., p. 34): "Duke does not believe nor intend that information from the proposed (baseline) monitoring program can or should be used to determine the specific success or performance of the specific HEP projects". Duke also argues that "restoration programs are more qualitative in nature, and produce ecological gains that may be difficult to measure in precise quantitative terms" (p. 22). This is not true and it ignores the advice of NRC committees and restoration scientists; it certainly <u>is</u> possible to measure ecological gains of restoration projects in quantitative terms".

Based upon the above discussion, staff concludes that the baseline monitoring proposed for the current Morro Bay HEP is not adequate to assess the key aspects of the Bay related to larval losses and the effectiveness of the habitat enhancement program.

Monitoring of Mitigation Progress and Efficacy

The Applicant has not proposed a detailed project-specific monitoring plan because the representative projects are only examples or concepts. The HEP states, "Each restoration project is unique, and performance criteria and monitoring plans and schedules will be tailored to meet the needs and goals of each project, once project selection and design are complete. Thus, it is not possible, or even desirable, to attempt to delineate the specific performance measures for the projects at this time, as sufficient data are not available " (DUKE 2002HEP_b, page 31). Staff also notes that the Applicant provides a very low estimate of monitoring funds needed to determine baseline and whether project-specific performance standards are being attained. Consequently, staff is unable to evaluate a real monitoring plan due to the preliminary nature of the representative projects.

If the habitat approach is approved by the Energy Commission, a comprehensive, long-term monitoring program should by developed, implemented, and managed by an independent panel of scientific experts. The purpose of the monitoring program would be to measure the ecological gains due to mitigation projects, and measure the overall ecological health of Morro Bay over the long-term. The Administering NGO would organize the monitoring program effort.

Staff would support the proposal that, prior to project implementation, the Administering NGO would work with other involved agencies to develop project-specific monitoring plans for each of the approved projects. However, this monitoring will also require data that can only be acquired through comprehensive baseline monitoring.

The Importance of Monitoring Performance Criteria

The performance (success) of specific habitat enhancement projects can be measured directly or indirectly by monitoring environmental variables that respond to project effects. The scientific review of past restoration efforts and methods as well as the examination of empirical data from similar projects should be an integral part of developing the project monitoring plans (Ambrose 2002a).

The variables that are monitored should be strongly representative of desired aspects of the project, as well as accurately and precisely measured. The criteria should also be scaled to the appropriate time interval within the monitoring plan. Monitoring habitat size, species abundance, and biological, physical, and chemical habitat characteristics may over time provide adequate information for determining success.

Staff agrees with the Applicant that the process of selecting mitigation performance variables must consider sensitivity to expected project changes, independence from influence of other unrelated variables, and reliability over time. However, it may be challenging to find such simplicity, independence and reliability in performance criteria due to the dynamic interrelated nature of ecological systems.

Development of the Monitoring Schedule and Monitoring Duration

Staff concurs with the Applicant's determination that the duration of the monitoring for a specific project will depend upon the specific performance criteria for that project. Staff recommends the monitoring program be developed and directed by an independent panel of scientific experts. Staff asserts that short-term, long-term, and "for the life of the project" monitoring would be necessary for approval of the HEP approach. The Applicant's HEP proposal does not include funds for this level of monitoring over the life of the project.

Success Criteria and Timely Corrective Actions

Monitoring will be related to project specific criteria. Staff recommends that specific corrective actions should be developed and specified in advance. An adaptive management approach is necessary and appropriate, so that the nature of the corrective action will depend on the reason the performance criterion is not being met. The Applicant states that "some monitoring programs would not address corrective measures until the completion of the monitoring program, which may be several years after project initiation. Other programs incorporate early corrective measures that can

be implemented prior to the completion of the monitoring program to ensure that the benefits of the project are being conferred as anticipated" (DUKE 2002HEP_b, page 33). This is insufficient. A list of acceptable corrective actions and criteria and adaptive management loops should be developed prior to the start of a given project. The individual monitoring for each program should be scientifically designed to suit the restoration goals, success criteria, and corrective actions. Adaptive corrections could result in different efforts from those initially attempted in order to reach performance standards. Additional funds would be needed for corrective (contingency) actions.

Overall, staff concurs that the monitoring program must be designed and managed carefully to account for uncertainties in the data, restoration methods, and success criteria.

8) SUCCESS CRITERIA FOR DETERMINING HEP'S PROPOSED REPRESENTATIVE PROJECTS

Staff requires the development of success criteria (performance standards) that are strongly related to the recovery and production of larvae. Section 3, pages 41 through 45 discusses the Applicant's success criteria for the HEP and outlines the importance of including success criteria that are easily measured, reliable and ecologically relevant. Staff understands that many specific criteria related to biological restoration would be determined in the future during individual project planning. At this time, the success criteria are not sufficient (refer to Dr. Ambrose's comments in **Appendix A**).

In addition, because it relates to the implementation and success of the proposed HEP projects, staff recognizes the need for close coordination of the HEP with the watershed and estuary projects being implemented by the MBNEP, ACOE, and the Regional Board. Refer to Table 2 on page 44 for specific goals of regional organizations that overlap with those of the HEP. For example, the Regional Board's watershed sediment control plan will focus on restoring Morro Bay's water quality by reducing sedimentation from upland regions of the local watersheds. One specific goal of this program is a 50 percent reduction in the rate of bay infilling, a reduction that models predict would extend the habitat service life of the bay by 150,000 acre-years, or 50 percent of the 300,000 acre-years of service left at the existing rate of sedimentation (Refer to Appendices I and J).

By the time the HEP is planned and implemented, conditions in the Bay may have changed significantly. Thus close coordination with other agencies and organizations would be required to develop, implement, and monitor the final HEP projects.

9) ADAPTIVE MANAGEMENT STRATEGY

The Applicant discusses management feedback loops and evaluation points in Section 3. However, staff would like to see more discussion and refinement of the adaptive management plan plus adequate funding included (discussed below). Adequate monitoring of the success of the projects is a key element of a successful adaptive management approach. Staff's concerns about the inadequacy of the on-going monitoring that is currently proposed as part of the HEP is discussed above.

10) THE IMPLEMENTATION PLAN OF THE PROPOSED HEP

The Applicant states "The Administering NGO would develop criteria for ranking potential projects that meet selection criteria. New projects will be selected in order to maximize the ecological benefits to the Estuary while coordinating with the projects and ongoing efforts of the Regional Board, the ACOE, and the MBNEP. The projects that are evaluated as being the most likely to be effective would be assigned the highest priority".

Staff has concluded from this review that the final projects are likely to change significantly from the representative projects, due to agency comment and expert opinion as well as current data on the status of habitats in Morro Bay. The Applicant proposes that, upon ranking of potential projects by the Administering NGO (MBNEP), the permitting agencies and advisory committee would select a list of projects to be undertaken. These projects would have to demonstrate a clear and valid nexus to entrainment losses. The list that mitigates CWIS losses may differ from a general "Estuary Priority Improvements List". Staff recommends that a Technical Working Group (TWG) be formed, to provide advice to the “advisory committee” (AC) and charged with the task of developing and/or approving project goals, success criteria, monitoring, schedule and adaptive management.

Although the HEP approach is reasonable and generally acceptable, staff concludes that implementation plan and schedule are insufficient at this time due to the need for more information on specific projects, funding for projects and monitoring, as well as coordination with regional and local agencies involved in restoration in Morro Bay (refer to **Appendix A,** pages 4-6).

11) CONTINGENCY PLAN OF THE PROPOSED HEP

On page 45, the Applicant presents its rationale for not including a contingency plan with its HEP proposal, “In its June 27, 2002 Scheduling Order, the Energy Commission suggested that the HEP should include contingency plans that may be implemented if performance standards are not met. While Duke agrees with this in principle, we believe contingency plans should only be necessary where ***overall*** program performance fails to provide ecological benefits that offset the entrainment effects of the modernized MBPP. Contingency plans are not necessary to address shortfalls in anticipated benefits that are above and beyond those needed to satisfy pertinent legal criteria.” Staff notes, however, that the Applicant has not provided as part of their proposal a means for evaluating the overall program performance over time, as discussed above.

In Section 3.4 the Applicant explains why it believes the HEP already contains an adequate safety marine such that contingency plans are unnecessary. It that’s that the safety margins were derived from a number of different considerations, “chief of which is the fact that the HEP is conservatively designed to offset 100 percent of the entrainment effects, assuming entrainment levels associated with annual average water usage of 413 MGD. Actual water usage, however, will be substantially below this level both as a result of the 370 MGD permit flow limitation and because the plant will not run at 100 percent capacity. In addition, the cost estimate for each representative habitat enhancement project is highly conservative (almost double the expected actual cost),

thus assuring the availability of sufficient funds to address problems or other contingencies that arise during project implementation." (DUKE 2002HEP_b, page 45).

The Applicant finishes with the assertion that " Duke is entitled to credit for the ecological benefits that will flow from projects that become feasible only through the existence of matching grants or other funds obtained through leveraging Duke funds. A safety margin fulfills the basic purpose of a contingency plan, i.e., insurance that the required ecological benefits will be realized. In this case, Duke believes that the magnitude of the safety margin built into the HEP obviates the need for a program-level contingency plan altogether." The Applicant states that the other biological services of the habitat enhancement program are an additional safety factor. Until the "other biological services" are reasonably defined and quantified, they are not suitable for inclusion in the "credit" or safety margin aspects in order to justify omitting a contingency plan from the HEP.

Staff supports the Applicant's intent to develop a synergistic approach to take advantage of other local and regional restoration efforts. However, the HEP should be evaluated separately and should be able to function independently of other projects, if need be. Leveraged funding obtained by the MBNEP is speculation and is not part of the Applicant's funding for the HEP. While staff supports incorporation of safety margins, conservative assumptions, and diverse restoration plans as a means of improving the chances of HEP success, staff disagrees with the Applicant's conclusion that no contingency funding is needed in this case. Staff believes that the Commission should require inclusion of a contingency plan with funding to accomplish it. This contingency plan should require that a minimum level of benefits (measured in terms of larval production) be achieved by the Applicant's HEP. In fact, staff believes that for a HEP to be found acceptable, a "safety margin" should be included in the form of a performance bond.

Staff concurs there must be fairness and consistency with respect to how uncertainties are addressed in assessing the success of the proposed mitigation projects. Staff recommends that a contingency plan be devised and included as a matter of accounting, so that adequate funds are allocated to deal with unexpected outcomes, despite the HEP's integral "safety" margins.

12) HEP FUNDING AMOUNT AND IMPLEMENTATION SCHEDULE

Section 7 of the HEP provides a discussion of the funding for the HEP (DUKE 2002HEP_b). The Applicant proposes the following funding allocation:

- Total guaranteed funding amount- $12.5 million. Total funding would not be reduced by credit mechanisms for performance, successful implementation of AFB technology, or decreases in water use;
- Initial Funding - $9.7 million. This amount was derived using highly conservative cost assumptions to cover the funding of the representative projects discussed in Section 5;
- Residual Funding - $2.8 million. This funding is provided as a safety margin for uncertainty, partial performance, or changes to underlying cost assumptions. It is

not required to offset entrainment effects, assuming successful implementation of projects; and

- Leverage Funding - $37-63 million The total $12.5 million may be leveraged through grant making process to attain more funds for restoration projects. Potential leverage factors of 3 to 5 times are provided (refer to HEP Section 7.7).

As currently proposed an initial $9.7 million would be disbursed as follows: 25 percent at the time the foundations for the modernized plant are poured, 50 percent upon commencement of commercial operation, and 25 percent two years after commencement of commercial operations. The safety margin funds ($2.8 million) would be contributed, on an as-needed basis as determined by the Regional Board, beginning five years after the first disbursement of initial funding.

By way of introduction, on page 2 of **Appendix A**, Dr. Ambrose states, "Duke's characterization of their funding estimates is misleading. Duke claims to have doubled the costs of implementing the habitat enhancement projects, but the estimates they doubled were for excavation or construction only and did not include the unavoidable costs of planning, design, management, permitting, monitoring, etc. The “safety margin” claimed by Duke is overstated. In general, the cost estimates are preliminary at best given the early stages of planning for all of the specific projects, and costs could be considerably higher than estimated".

Staff has two major types of concerns about the amount of funding proposed. First, staff believes that the scientific data and assumptions used in the HEA model may overestimate the effectiveness of the projects described. To the extent that this is the case, the Applicant’s estimates of funds needed to achieve the desired level of mitigation may be significantly underestimated. Second, staff is concerned that the HEP proposed by the Applicant does not incorporate adequate funds for project implementation, monitoring, and contingency planning. Each concern is discussed below.

Staff has determined that the initial funding level may not accurately reflect the actual amounts of money required to achieve the project objectives, based upon staff’s concerns about the accuracy and assumptions of the HEA model (as previously discussed, regarding accurate habitat acreages in the bay, the types of habitats in need of restoration, the real costs of implementing types of projects in-bay restoration projects, and monitoring for baseline and project-specific progress). The HEA model output in terms of acreage may change significantly thus changing the amount of money needed to achieve adequate mitigation.

The HEA model analysis must be performed with accurate input data and inclusion of sufficient monitoring and contingency plans. Refer to Table 6 (DUKE 2002HEP_b, page 98) entitled, Revised HEP Funding Proposal. The HEP funding proposal also does not include sufficient funding for HEP project implementation a major concern addressed in more detail in **Appendix A** (particularly pages 7-8 and discussions of specific projects). Staff believes that the Applicant’s success of 100 percent - to be achieved by every project undertaken - is overly optimistic. Restoration projects designed as mitigation typically call for the creation of more protected, restored, or enhanced habitat than that

which is lost/affected so that the mixed success of such projects will still fully mitigate the impacts. In the case of the Applicant's proposed HEP, staff estimates that a 50 or 60 percent success rate is reasonable and recommends using this assumption to develop a more realistic mitigation value. This may double the proposed funding needed for mitigation, to $25M based on the modeling results included in the Applicant's HEP proposal.

If an adaptive management strategy is to be successfully implemented, additional funding will need to be provided to modify or switch to an alternative project/strategy if mitigation success is not achieved. Duke proposes in Section 7.6 a funding cap of $12.5 million for the HEP. The $9.7 million for project cost was developed using a "bottom up" approach as well as a 30 percent contingency factor. However, the data upon which the HEA model was based (and the assumptions), and thus the final acres to be restored may change substantially. The total funding does not include additional funds for planning, permitting, management, the baseline monitoring program, specific project monitoring, administration, and contingency projects/actions, and is considered insufficient. Consequently, staff is unable to determine that the cap is justified or accurate.

Restoration Project Funding

Staff believes that the Applicant's success of 100 percent - to be achieved by every project undertaken is overly optimistic. Nor does staff agree with the basic premise of comparing larval biomass losses with adult fish biomass. These could greatly affect the size of restoration areas needed and their associated costs. Restoration projects designed as mitigation typically call for the creation of more protected, restored, or enhanced habitat than that which is lost/affected so that the mixed success of such projects will still mitigate the impacts to an acceptable level. In the case of the Applicant's proposed HEP, staff estimates that a 50 or 60 percent success rate is reasonable and recommends using this assumption to develop a more realistic mitigation value. Staff recommends proceeding conservatively regarding project costs. Since there is no specificity for the actual projects or their costs, staff recommends that the applicant provide adequate funds to provide a safety cushion. Staff proposes that due to the concerns with the Applicants cost estimates, that the Applicant provide twice their proposed $9.7M. This would be ($9.7M X 2 = $19.4M. This amount would provide needed insurance that sufficient mitigation is accomplished. This level of funding may be high or low. The actual costs will not be known until specific projects are designed, implemented, and determined successful (or require contingency efforts). Excess funds could be returned to the Applicant when the mitigation program is determined successful, or additional funds could be needed beyond the initial amount. Staff has attempted to address "additional projects" and "corrective actions" contingencies by recommending a contigency fund is established (see below).

Monitoring Funding

Without adequate baseline monitoring and on-going project-specific monitoring it would be impossible to determine whether the projects attain predetermined performance standards and result in successful mitigation. The actual costs for these two types of monitoring are unknown at this time, but staff estimates that on average $250K per year, especially during the first three decades would be a reasonable estimate. Using this estimate, staff recommends that an $8M "Monitoring Fund" be established (using 3

percent interest, revenue produced annually would be 3% X $8M = $240K/year). This fund would provide monitoring revenue over the time needed to conduct monitoring. Excess funds could be refunded when the Energy Commission and Regional Board determine no further monitoring is needed.

Contingency Funding

Although the Applicant did not provide contingency funding, staff recommends $6M be placed in the contingency fund to ensure that corrective actions or alternative projects can be undertaken. Interest would accrue to this fund. Excess funds could be refunded when the Energy Commission and Regional Board determine there is no further need for contingency funds.

Project Administration Funding

There is also a need to fund administration of the "mitigation plan". Staff recommends $100K-150K/year be provided for administration funding. A $4M endowment, using 3 percent interest revenue per year would provide $120K/year for administration needs. Administration includes the work overseeing project planning through successful project completion.

Funding Schedule

The estimate of total funding is $37.4M. Staff recommends a performance bond or similar arrangement be provided at certification of $37.4M. At the end of the power plant project life or earlier by a determination of the Energy Commission and Regional Board, funds remaining could be refunded to the Applicant. This could ensure success of the mitigation with a reasonable degree of certainty. There would still be uncertainty. Providing the funds up-front at certification would allow efforts to begin at that time toward implementing the mitigation. The restoration projects will take years to identify, plan in detail, and obtain needed permits. It is likely the new power plant would be operating before any projects are started, and actually providing mitigation value. This up-front funding of the performance bond would move mitigation forward at the earliest opportunity. Staff would be willing to consider a phased funding for portions of the funding as feasible and appropriate if desired.

In summary, staff believes that if the HEP is approved, the amount, structure, and schedule for the funding will need to be refined, as the HEP projects are determined. Staff has determined that the $12.5M offered by the Applicant underestimates the funding needed. Staff also recommends that the funding would be required at certification, as a performance bond so that the work of project identification, planning, management goals, and monitoring efforts can get underway immediately. These efforts will take several years to get underway, and determining success could take decades to accomplish.

AQUATIC BIOLOGICAL RESOURCES TABLE 1
Staff Estimated Funding

Project Element	Funding
Mitigation Projects ($9.7M @ 2:1 Ratio = $19.4M)	**$19.4M**
Contingency Projects (adaptive/contingency project = $6M plus accrued interest)	**$6M**
Monitoring (baseline and project specific, $250K/year from a $8M monitoring endowment)	**$8M**
Administration ($150K/Year = $4M endowment)	**$4M**
Total	**$37.4M**

13) GOVERNANCE STRUCTURE OF THE PROPOSED HEP

The Applicant has provided a structure for HEP governance in Section 8. Staff has several concerns and recommended changes regarding the governance of the HEP.

The Applicant proposes that the HEP projects would be administered by a qualified independent, private non-profit organization, new or existing, subject to primary oversight by the Regional Board. An Executive Board would be created with a diverse stakeholder membership to oversee the Administrative NGO and would be in charge of implementing the representative habitat restoration projects discussed in Section 5 as well as soliciting, reviewing, and recommending additional habitat restoration and preservation projects to the extent funds are available. An important aspect of the HEP's Administering NGO is that it would work in close coordination with the Executive Committee of the MBNEP. The Executive Board would also consider the in-bay restoration planning process being conducted by the ACOE and the Regional Board.

Staff supports portions of the above governance concept. Staff recommends the establishment of a Technical Working Group (TWG) with restoration and aquatic biology expertise. The TWG would be established by the Energy Commission and the Regional Board to help make scientific and management decisions, analyze data and evaluate success of the HEP projects. Initially, an Advisory Committee (AC), composed of representatives from applicable agencies and other stakeholder groups, would assist in identifying appropriate mitigation projects. They would assist in producing a "Mitigation Plan" with a strong clear nexus to the impacts of once-through cooling.

The preparation of the "Mitigation Plan" and the details for accomplishing the "Mitigation Plan" would be developed following certification by the Energy Commission and permitting by the Regional Board, and be accomplished by the AC, with ultimate plan approval by the Energy Commission and the Regional Board. This implementation structure and function is similar to that proposed by the Applicant. The main difference is that the Applicant proposes that the Regional Board be the lead and that the Energy

Commission function a member of the Executive Board. Staff recommends that the Energy Commission would assume role as co-leader with the Regional Board in order to fulfill their regulatory compliance and other legal responsibilities. Additionally staff recommends that the Energy Commission and the Regional Board would act as co-leaders and have final decision authority. The TWG would provide review and advice regarding the appropriateness and probability of success of projects, their management, monitoring, performance standards (success criteria), quality control, and data review. This organizational approach is flexible and is intended to allow the Administering NGO (such as the MBNEP) to use it's existing structure and process as much as possible. For example, the AC and TWG could be incorporated into the existing MBNEP framework to avoid overlapping committees and layers of oversight.

The TWG would report to the AC and assist the Administering NGO, to ensure that their technical and analytical expertise is available to judge project performance, effectiveness, and to recommend adjustments. The Administering NGO would administer the "Mitigation Plan".

Following the preparation of the initial "Mitigation Plan", the AC would only convene to make decisions on the appropriateness of specific projects. The Administering NGO would accomplish the goals and objectives of the plan. As the Administering NGO identifies appropriate projects, the AC would be consulted for project approval.

Staff recommends that the mitigation funds should be provided at certification and implemented through a memorandum of understanding (MOU) between the Energy Commission, the Regional Board, and MBNEP. The ultimate disbursement of the funds would require approval by CEC and Regional Board. This approval could be project specific and/or annual or multi-year budget plans.

Finally summary, staff recommends that the Regional Board and Energy Commission should have co-leader roles in accomplishing the following (DUKE 2002HEP_b, page 27):

- planning and designing the implementation of the representative projects identified in Section 5 or other projects that will provide comparable benefits;
- refining the governance structure and other administrative aspects of the program;
- overseeing actual project identification and implementation;
- tracking the performance of these projects over time; and
- seeking opportunities for coordination with other existing bay protection and enhancement programs.

COMMENTS

AGENCY COMMENTS

At this time, staff has not yet received comments from other agencies regarding the Applicant's HEP proposal. This is due to the tight schedule and lack of review time.

The **National Marine Fisheries Service** (NMFS) is the federal agency that reviews proposed federal and state projects regarding their impacts to Essential Fish Habitat. NMFS has stated unequivocal support for avoiding and preventing the adverse impacts caused by once-through cooling. NMFS most recently wrote a letter (received June 10, 2002) stating, "Although NMFS is not opposed to a habitat enhancement concept in all cases, NMFS believes that this approach is inappropriate for this particular project." (NMFS 2002a, page 2). The NMFS recommends compensation when the proposed project has exhausted all feasible modifications and construction techniques to minimize adverse environmental impacts. In addition, the NMFS asserted that there are existing programs in Morro Bay, and that while the HEP may assist in achieving habitat acquisition and restoration, the effectiveness of this mitigation approach is not easily assured. NMFS concludes, "Based upon the numerous uncertainties associated with this approach (the HEP), and in light of the fact that a feasible option for avoidance is available, NMFS argues that the habitat enhancement approach is not the best available technology for reducing entrainment and impingement impacts associated with the CWIS." (NMFS 2002a, page 3).

PUBLIC COMMENTS

Comments from Mr. William Peirce, of Morro Bay (WP-1) received via email on September 11, 2002. Mr. Peirce's comments regarding the problematic sedimentation that has been occurring in Morro Bay is noted.

WP-1: "I was not able to attend the HEP workshop in Morro Bay, today [9/10/02], but did watch part of it on television. Both Tom Laurie and the Fish & Game representative made statements that need addressing.

As a Morro Bay City Councilman I was present for the dedication of the Chorro Flats Sediment project. I was also present when, during the first winter following its dedication, the Chorro Creek Bridge area received a record amount of silt. Our engineer estimated that we lost about 10-years of service life from the bridges from that first winter. Project representatives defended their work, but didn't have any funds to correct the problem.

I have lived in Morro Bay, for the most part, since 1968. During that time, I have seen the persistent March of situation destroy huge amounts of the bay. What was once healthy estuary became mud flats. Additionally, the area between the moored boats and the sand spit was formerly large enough to sail in. But the marching sand has encroached almost all the way out into the mooring field.

Last year the City of Morro Bay was able to obtain permits and enough money to attempt some maintenance dredging in that void between the sand spit and the moored boats. It was help, but it was also akin to shoveling a path across Antarctica with a snow shovel. It keeps you busy but you don't notice much progress.

The statement from the Fish & Game representative indicates that she reads a lot and attends conferences, but doesn't know much about Morro Bay. I've spent a lot of time here and frequently simple observation tends to make the scientific data we've heard lately just a bit suspect.

Spend some time here and you'll soon discover what is practical, the data that is purely hypothetical, and the Bandini which has no basis in reality."

Response: *Comment noted and also forwarded to California Department of Fish and Game.* If the HEP were approved by the Energy Commission, staff would be interested in restoration projects that would restore mudflats, and other sensitive, rare, and productive habitats in Morro Bay. Staff also is aware of the simultaneous importance of implementing erosion and sediment avoidance and minimization practices in the watershed in order to slow the rate of sedimentation.

CURT BEEBE, M.D. (CB) [COOLING]

CB-1: "I am against continued diversion of water from Morro Bay for cooling the power plant. I am in favor of dry cooling instead."

Response: *Comment noted but it does not pertain directly to the HEP proposal.*

WALT FRENCH, LOCAL UNION 409 (WF) [HEP]

WF-1: "Please implement the Habitat Enhancement Program, and utilize the funds Duke Energy is offering. We feel this approach will be beneficial to the overall health of Morro Bay. We further request that the California Energy Commission expedite the Licensing of this Plant. It will bring much needed jobs to our community."

Response: *Comment noted.*

SUMMARY

In staff's opinion, avoidance of the impacts of the proposed MBPP by eliminating or avoiding once-through cooling is the only certain way to mitigate the significant adverse impacts of once-through cooling. Modification of the project to use an alternative cooling system remains staff's recommendation. The Applicant's HEP proposal submitted on August 30, 2002 provides information and a structure that is suitable for evaluation. The Applicant has also explained its nexus for the HEP. If the HEP strategy is approved, staff would like to see a more refined nexus. In addition, some of the assumptions and data, upon which the HEA model is presently calculated, are not accurate at this time. As a result, staff recommends that the model be re-run using appropriate data and assumptions. Furthermore, the means by which the HEP

effectiveness would be measured are too vague and indefinite to be evaluated, and must be further clarified.

Using a strong nexus, accurate habitat mapping data and coordination with regional and local organizations and agencies, the HEP could potentially mitigate the adverse impacts of the proposed project. However, staff cannot determine from the information provided thus far, that the HEP as currently proposed by the Applicant will provide sufficient mitigation for the impacts caused by the proposed MBPP over the life of the project.

UNRESOLVED SIGNIFICANT CONCERNS REGARDING THE APPLICANT'S PROPOSED HEP

In its analysis above, staff has identified important issues that would need to be resolved in a revised HEP for the proposal to adequately mitigate the impacts from the MBPP. These issues are discussed in more detail in previous sections and **Appendix A**, and are summarized below.

- Staff would like to see a stronger and more refined nexus between the impacts of the continued use of the CWIS and the restoration actions and success criteria.
- Staff's analysis identifies major problems with the data that went into the HEA model. As such the resulting output and specific mitigation level (acreage) for the proposed project may change significantly. For example, the HEA model is not based upon the most accurate and current habitat mapping and characterizations.
- Staff has concerns about several of the assumptions that were defined in the HEA model and used to present the representative projects.
- Staff would like to see more evidence of coordination with the MBNEP and ACOE regarding the value and feasibility of the representative projects. The representative projects provide a good start, however, staff believes that improved projects, attention to protection and enhancement of existing and threatened habitats (fringe wetlands, mudflats, saltmarsh, riparian), and the excavation of sediment-laden areas in the southern area of the Bay should be priorities, and tightly related to the nexus.
- Staff also has concerns about the success criteria and monitoring endpoints of the projects , which focus too narrowly on the success of specific projects as opposed to the success in mitigating the impacts from the MBPP. The current proposal lacks well-developed plans for baseline, project-specific implementation and monitoring, and adaptive management.
- Staff does not support exclusion of a contingency plan.
- The above concerns are closely related to staff's determination that the proposed funding for the HEP is insufficient at this time.
- Finally, if it is approved , staff prefers to see a governance structure that would enable the Energy Commission and Regional Board to co-chair the HEP.

In order to recommend the HEP, staff would need to have these concerns resolved satisfactorily.

COMPLIANCE WITH LAWS, ORDINACES, REGULATIONS, AND STANDARDS (LORS)

This section lists the various LORS applicable to both the Energy Commission approval of the HEP, and to approval of the individual HEP projects themselves.

The final HEP projects will need to be reviewed and permitted sometime in the future. In order to ensure that the activities of the individual HEP projects do not result in significant environmental impacts, the permitting agency shall act as Lead agency under CEQA. In addition, the projects will need to be reviewed to ensure compliance with applicable LORS. For example, the final individual HEP projects may need to be evaluated to determine their potential to result in "take" of listed and protected species and habitats. If such potential exists, relevant permits will need to be obtained. Similarly, any potential dredging to help create habitat will need to be evaluated in order to address any other environmental impacts, such as disposal of the dredge material. The following is a brief summary of potentially applicable legal requirements:

- The MBPP must comply with the requirements imposed by CWA sections 316(a) and (b), which are addressed by the Central Coast National Pollution Discharge Elimination System (NPDES) permit. This permit will identify BTA for the cooling water effects and thermal discharge effects due to once-through cooling ;
- The Lead Agency for both the MBPP (Energy Commission) and the Lead Agency(ies) for the individual HEP projects will need to comply with CEQA in reviewing the proposed activities.
- The MBPP will and some of the individual HEP projects may need to comply with the CWA Section 404, which requires a permit for activities that involve dredging and other impacts on waterways;

The MBPP will and some of the individual HEP projects may be subject to a Section 7 consultation between the permitting federal agency and USFWS for impacts to federally listed species, which in turn will require the issuance of the Biological Opinion by USFWS;

The MBPP and some of the individual HEP projects may require consultation between the permitting federal agency and NMFS on Essential Fish Habitat;

The MBPP will and the individual HEP projects may require a Section 2081.1 Biological Opinion Consistency Determination and take permit from CDFG for impacts to special status species;

The MBPP will be the subject of a report regarding the consistency of the project with the Coastal Act and related LORS as determined by the Coastal Commission in its 30413(d) report. These include maintaining, enhancing, restoring and protecting areas of biological significance, and minimizing entrainment;

The MBPP will need to comply with the Porter-Cologne Act section 13142.5(b) which requires in a power plant, the best design, technology, and mitigation feasible to minimize intake mortality of all forms of marine life;

The MBPP and individual HEP Projects will need to comply with CWA section 320 which requires protection and improvement of National Estuaries;

The MBPP and the individual HEP projects will need to comply with CWA 303(d) which requires extra protection for Morro Bay as an impaired water body (pertains to the larger MBPP project and the HEP).

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Staff evaluated the Applicant's proposed HEP. Staff believes that the proposal provides a potentially workable framework for mitigating the aquatic biological impacts from MBPP. However, as discussed above, the current proposal has a number of flaws that serve to underestimate the amount of restoration and mitigation that would be required, resulting in an underestimate of the funding needed to support full mitigation. The key problems identified by staff are:

- The need for a more refined nexus between impacts and mitigation;
- Underlying problems with the scientific data, assumptions, and application of the HEA model to this case;
- The ecological responses to be achieved by the HEP need to be developed in terms of overall mitigation effectiveness in addition to specific project success;
- An unrealistic estimate of 100 percent success for the projects included in the HEP and lack of accounting for habitat degradation over time due to other stressors in the Bay;
- Lack of adequate baseline and on-going monitoring (and funding) of the HEP;
- Lack of adequate funding for administration and implementation of the HEP projects;
- Lack of funding for contingency projects as part of the adaptive management of the HEP throughout the life of the MBPP; and
- Inadequate total funding.

These issues must be resolved for the HEP proposal to meet the Committee's criteria, laid out in the hearing order, for an adequate HEP. Until the application of the HEA model to this case is corrected, the current description of the HEP will not be adequate to ensure actual compensation for the environmental impacts (Committee criterion 1). Until the target ecological responses of the HEP in terms of overall effectiveness of mitigating the MBPP impacts is developed, the performance standards for accomplishing the HEP goals and objectives will be inadequate (Committee criterion 3). Unless the plan is modified to ensure adequate baseline and ongoing monitoring and sufficient funding for contingency projects, the HEP will lack a mechanism to ensure that corrections to the plan can be made in a timely manner (Committee criteria 5 and 6). Staff has identified serious shortcomings in the Applicant's estimates of project costs and concerns about the payment schedule. Staff has been unable to establish substantiated project costs during this review of the Applicant's proposal, but has presented initial estimates. Staff agrees with the Committee's criterion 7 that an adequate HEP must include substantiated cost estimates and an enforceable payment

schedule, and believes that these estimates and an appropriate schedule could be developed by the various parties after the shortcomings listed above were addressed.

Staff believes that these problems can be fixed in a manner that could make the HEP approach an adequate and acceptable means to mitigate the impacts of the MBPP, though some uncertainty will remain in the ultimate ability of the HEP to fully mitigate the MBPP impacts. However, these fixes are likely to be expensive. Staff has not had the time to develop more realistic assumptions for the HEA model or to run the model, so no estimate of the specific changes to the HEP that would be needed are possible at this time.

Staff has not evaluated the approach for developing a mitigation plan used by Regional Board staff in their recent staff reports to the Regional Board. While the Regional Board staff's approach differs in some key aspects from the Applicant's proposal, Energy Commission staff believe that the same types of adjustments and refinements discussed above would be needed if the Regional Board and Energy Commission decided to move forward with the Regional Board staff's approach.

Staff has not changed its determination that the preferred approach is to avoid the adverse biological impacts caused by the CWIS, particularly entrainment, but also including, impingement and thermal discharge. Staff has determined that dry cooling is a feasible alternative to the proposed use of once-through cooling, though this question remains in dispute and has not been resolved by the Committee.

RECOMMENDATIONS

In the FSA part 3, staff stated that it could not recommend approval of the Morro Bay Power Plant Project until the Applicant provides a proposal for adequate mitigation for aquatic biological resource impacts under CEQA and that will demonstrate LORS compliance. Staff's analysis shows that the entrainment impacts are significant under CEQA, and represent an adverse impact to Morro Bay under the federal Clean Water Act. Staff recommended at the time that the mitigation be dry cooling or other alternative cooling system that would eliminate aquatic biological resource impacts.

Staff continues to believe that, to the extent feasible, avoidance of the impacts to marine resources is preferred. Staff has reviewed the proposed HEP and has identified major and minor concerns with the proposal. Staff does not recommend the HEP as currently proposed as mitigation for the significant impacts of once-through cooling. If the flaws in the HEP are addressed, there will remain uncertainty surrounding its success in mitigating the impact.

Should the Committee determine that the HEP is the appropriate mitigation for the adverse impacts of the proposed project, staff recommends the careful creation of appropriate Conditions of Certification, in order to provide the best attempt at successful and defensible mitigation.

CONDITIONS OF CERTIFICATION

Staff would craft Conditions of Certification if the Committee so directed, but cannot do so at this time due to a lack of opportunity to coordinate with the Regional Board to the extent necessary. If the HEP form of mitigation was approved by the Commission, staff would collaborate with the Regional Board to establish Conditions of Certification regarding the following:

1. Appropriate level of mitigation, as determined by the HEA using accurate input data and assumptions based on an appropriate nexus;
2. Identification of appropriate performance criteria for determining success of HEP programs;
3. Fund amount, timing of payment(s), performance bond, and fund management;
4. Administration of the Mitigation Plan, TWG, AC, and MBNEP roles;
5. Monitoring to determine when performance standards are achieved. Contingency planning and funding.

REFERENCES

Ambrose, R.F. 2002a. Wetland Mitigation in the United States: Assessing the Success of Mitigation Policies. *Wetlands (Australia)* 19:1-17.

CCC (California Coastal Commission) 2002a. Comments on the Morro Bay Power Plant Habitat Enhancement Proposal. Submitted to the California Energy Commission July 15, 2001.

CCC (California Coastal Commission) 2002b. Personal Communications with CCC staff regarding the Morro Bay Power Plant Habitat Enhancement Proposal. September 16, 2002.

CAPE (Coastal Alliance on Plant Expansion) 2002hep_DReq. CAPE's Data Requests pertaining to DUKE's HEP Proposal of July 1, 2002. Submitted to California Energy Commission on July 15, 2002.

Cited in text as: (CAPE 2002HEP_a)

CEC Staff (California Energy Commission Staff) 2002HEP_a. CAPE's Data Requests pertaining to DUKE's HEP Proposal of July 1, 2002. Filed with the California Energy Commission Docket Unit on July 15, 2002.

Cited in text as: (Staff 2002HEP_DReq)

DUKE (Duke Energy Morro Bay LLC) 2002hep_a. Application for Certification, Habitat Enhancement Program Proposal, Morro Bay Power Plant Project (00-AFC-12). Submitted to the California Energy Commission on July 1, 2002.

Cited in text as: (DUKE 2002HEPa)

DUKE (Duke Energy Morro Bay LLC) 2002hep_b. Responses to data requests issued by CAPE and Staff, including updated HEP Proposal. Submitted to California Energy Commission on August 30, 2002.

Cited in text as: (DUKE 2002HEP_b)

DUKE (Duke Energy Morro Bay LLC) 2002hep_c. Additional responses to data requests issued by CAPE, including updated HEP Proposal. Submitted to California Energy Commission on September 6, 2002.

Cited in text as: (DUKE 2002HEP_c)

NMFS (National Marine Fisheries Service) 2002a. Letter to the Central Coast Regional Water Quality Control Board Regarding the "Status Report on Duke Energy's Proposal to Modernize the Morro Bay Power Plant and Renew their National Pollution Discharge and Elimination System (NPDES) Permit". Dated May 30, 2002. Received at the California Energy Commission June 10, 2002.

MBNEP (Morro Bay National Estuary Program). 2002a. Draft Map of Morro Bay Habitat Types. Received by the California Energy Commission September 6, 2002.

APPENDIX A

COMMENTS BY RICHARD F. AMBROSE - September 13, 2002

I reviewed the "Morro Bay Power Plant Modernization Habitat Enhancement Program" report by Duke Energy Morro Bay LLC, including appendices. I have focused my comments on the habitat enhancement aspects of the report, especially the aspects related to wetland restoration. However, I also comment on some key issues associated with Duke's use of the Habitat Equivalency Analysis (HEA), project costing and monitoring.

This review is organized into five sections: (1) a summary of conclusions, (2) general comments about the Habitat Enhancement Program, (3) comments on the specific in-bay restoration projects, (4) comments on the Habitat Equivalency Analysis, and (5) other concerns.

SUMMARY

- Habitat enhancement projects such as proposed by Duke can provide appropriate habitat for wetland fish populations. The abundance and species composition of fish assemblages in restored wetlands is usually similar to that in natural wetlands, although some studies have shown that restored wetlands do not perform some of the fish-related functions (such as nursery or feeding habitat) performed by natural wetlands. There is also uncertainty about whether the productivity of restored wetlands matches that of natural wetlands. As for the other ecological benefits of wetland restoration, well-designed restoration projects can provide substantial ecological values, but many problems have been documented in restored wetlands. The science of restoration ecology is still young and there is much we do not know and cannot anticipate. All restoration projects need to be approached cautiously and with the understanding that there is considerable uncertainty about their success. The HEP does not recognize this uncertainty
- The in-bay restoration projects presented in the HEP seem to have worthwhile objectives, but there remain a number of critical uncertainties. For example, the hoary cress removal project will only be successful if hoary cress cannot occur at lower elevations in the salt marsh, but this has not been documented in the report. Some of the assumptions about the restoration projects that feed into the HEA, particularly the timing of resource production, are overly optimistic. In addition, the HEA for the eelgrass restoration overstates the benefits of converting mudflat to eelgrass because it does not subtract the biomass production of mudflats from eelgrass habitats in order to calculate a net benefit. The sandspit stabilization project is so vague that estimates of costs and benefits are meaningless. The success of this project is also uncertain given the failures of previous efforts.
- Duke's use of a Habitat Equivalency Analysis is fundamental to its calculations of the amount of habitat enhancement needed to compensate for larval entrainment losses. HEA has been used extensively elsewhere but the appropriateness in this case is really a policy decision, especially since Duke's losses are not habitat based

even though HEA is typically applied to impacts to habitats. Like all models, HEA is dependent on the assumptions and parameter values used. Duke does not fully explain many of the critical assumptions made, and the assumptions consistently overstate the benefits of the HEP projects by underestimating the time to full productivity of a habitat, overestimating the productivity of a habitat, and overestimating the lifespan of a project.

- Duke's characterization of their funding estimates is misleading. Duke claims to have doubled the costs of implementing the habitat enhancement projects, but the estimates they doubled were for excavation or construction only and did not include the unavoidable costs of planning, design, management, permitting, monitoring, etc. The "safety margin" claimed by Duke is overstated. In general, the cost estimates are preliminary at best given the early stages of planning for all of the specific projects, and costs could be considerably higher than estimated.

HABITAT ENHANCEMENT PROGRAM

Setting aside the issue of whether a habitat enhancement plan is appropriate technology for the Morro Bay Power Plant (MBPP) modernization, there are several key issues to be addressed in evaluating the proposed restoration projects.

1. Will the proposed plan compensate for the larval losses? Will the proposed plan increase wetland fish productivity? Is the increase sufficient to compensate for the losses?
2. What will be the added ecological benefits of the proposed plan? Are the stated benefits likely to occur in fact, and are they sufficient to counteract the "inherent uncertainties in this type of project" (p. 2).

These issues are discussed in the next subsections of this report. Issues concerning the sufficiency of the proposed plans depend on the Habitat Equivalency Analysis (HEA); I make some comments about specific application of HEA in these subsections, but discuss other general issues in the section on HEA (page 6).

WILL THE PROPOSED HABITAT ENHANCEMENT PROGRAM COMPENSATE FOR THE LARVAL LOSSES?

In order to compensate adequately for the larval losses caused by the MBPP, the Habitat Enhancement Program (HEP) must increase the production of wetland fish. In general, wetland restoration projects have been found to be successful in providing appropriate habitat to support wetland fish populations. In southern California, Zedler and colleagues found that fish populations, as determined by beach seines, quickly colonized a restored wetland, and that densities and species composition of the restored wetland was similar to a reference wetland (Zedler et al. 1997, Desmond et al. 2000, West and Zedler 2000). Ambrose and Meffert (1999) also found that the fish assemblage of a restored wetland was similar to that found in natural wetlands. In many ways, fish seem "easier" to restore than vegetation or invertebrates, in that they respond quickly to the provision of appropriate habitat.

However, the general similarity of fish assemblages between natural and restored wetlands does not necessarily mean that the restored wetlands provide the same levels of functions as the natural wetlands. Zedler et al. (2000) found that restored wetlands typically lack the small tidal creeks and sinuous channels of natural marshes. Moreover, these small tidal creeks are important nursery areas for some common wetland fish species.

Little is known about the productivity of restored wetlands compared to natural wetlands. Productivity of restored wetlands is not necessarily comparable to natural wetlands even if the fish assemblages are similar, since the restored wetlands may lack landscape features (e.g., small tidal creeks) and food web support such as a productive invertebrate fauna.

Duke determines the sufficiency of the habitat enhancement program by using a Habitat Equivalency Analysis. This analysis makes a number of assumptions (see comments below), but the fundamental assumption is that the ecological significance of the fish and crab larvae entrained by MBPP is solely related to their biomass. They assert that habitat limits these populations and there is no relationship between larval supply and population dynamics (at least within the range of the MBPP impacts). They provide no evidence to support this assertion. Further, they assume that the biomass of fish and crabs occurring in wetlands (benthic adults) is ecologically equivalent to the biomass of larvae. Duke calculates fish production based on trophic conversion factors. The factors they use seem reasonable based on the general literature, but the actual conversion factors for the Morro Bay system (or similar California estuaries) are not know. The appropriate conversion factors for a *restored* California estuary is even less certain.

WHAT ARE THE ADDED ECOLOGICAL BENEFITS OF THE PROPOSED PLANS?

Duke states that the “other biological services” of the habitat enhancement program to serve as a safety factor. Thus, it is relevant to consider what services may be expected. For wetland restoration projects in general, **ecological success** is generally considered to have occurred if the restored wetland performs the same biological functions as a natural wetland. The literature on wetland restoration is full of examples where this has not occurred. In some cases, the failure of a restoration project is obvious and few ecological benefits or services are provided. However, even where outright failure has not occurred, detailed studies generally have shown the functions that occur in natural wetlands are not duplicated by the restored sites. Zedler and her colleagues (Zedler and Langis 1991, Zedler 1996) have provided a number of examples of both outright failures and inadequate functioning for California wetlands.

Craft et al. (1999) have conducted one of the most comprehensive assessments of biological functions in restored wetlands of various ages along the East Coast. They found that vegetation responded fairly quickly, converging with vegetation in natural marshes in only a few years. (Note that these East Coast *Spartina* marshes are less complex than the high salt marsh communities in California, so the relevance of these results to California wetlands is not clear.) Invertebrates responded more slowly (see also Moy and Levin 1991). Finally, soil characteristics (such as soil organic matter and

nutrient content) were very slow to converge to the characteristics of natural wetland soils, remaining dissimilar after 25 years. These results are consistent with the findings of many other studies.

Craft et al.'s study provides insight into the structural characteristics of wetlands, but they did not study wetland functions *per se*. Many important wetland functions, including food chain support, nutrient cycling, and resilience, may not follow directly from wetland structures.

Well designed and implemented wetland restoration projects will probably provide some habitat values. However, even well-designed restoration projects can have problems; there is much we still do not understand about wetland ecosystems. In most cases, however, it is possible to get vegetation to grow, fish and invertebrates to colonize, and birds to utilize a restored wetland. It is less certain that these taxa will occur in the same abundance and diversity as they would in a natural wetland. And it is even less certain that the functions performed by natural wetlands will be duplicated by the restored wetland. Some of the functions that may not occur to the same degree in restored wetlands include food chain support (i.e., provision of food), protection of early life stages (nursery), and nutrient cycling.

COMMENTS ON SPECIFIC RESTORATION PROJECTS

Below, I comment on the three in-bay restoration projects.

REMOVAL OF HOARY CRESS FROM CHORRO DELTA

The excavation of the Hoary Cress area, including the excavation of the adjacent tidal channel, is technically feasible and is unlikely to pose any special challenges beyond the normal difficulties of working in tidal marshes. It appears that the excavation will completely remove all of the vegetation. If so, this will remove the hoary cress. Hoary cress is a difficult species to control, and excavation is not the normal control method. (Traditional control methods focus on chemical control, although persistent mechanical control seems to be possible.) Since excavation is not the normal control method, there is some uncertainty about how successful it will be, although it seems logical that it would be effective. Hoary cress removal may not be complete if there are some pockets of marsh that are not excavated, and re-invasion could be possible from these remnant populations (or, for that matter, from other sources). The report asserts that hoary cress cannot tolerate the salinities of lower elevation marshes; if true, this would prevent it from re-invading. A review of a number of internet sites on invasive plants could not confirm this. Hoary cress was reported as being a problem in salt marsh (and other habitats) in central California, but I could not find a reference showing that it would not occur lower in the marsh. This is a critical point, because the restoration project would not be successful if hoary cress re-invades.

Once the sediment is excavated and the site re-contoured, this restoration project will be like most tidal salt marsh restoration projects (see discussion above). Vegetation will have to be re-established on the site, either by active planting or passive revegetation. (The report mentions avoiding the costs of replanting vegetation in anticipation of natural revegetation.) Many restoration projects have been able to establish vegetation

successfully through active planting, although some have failed. Similarly, passive revegetation is often successful, especially for pickleweed. However, there are a number of examples were passive revegetation has not been successful, and there is also concern that species besides pickleweed will not colonize naturally, so the restored marsh may not contain the full species richness of a natural marsh. Moreover, natural revegetation can take longer than active planting, with full vegetation cover taking five years of longer to become established. This delay should be incorporated into the HEA.

It is not clear what the sediment characteristics will be at the restoration site. Presumably, excavation will be to a soil horizon that was previously salt marsh, so soil characteristics (grain size, organic and nutrient content) should resemble natural marsh characteristics, which will increase the odds of this restoration being successful.

RESTORATION OF MUDFLAT AND EELGRASS HABITATS

In this project, eelgrass habitat is to be "created" by dredging mudflat habitat. It should be emphasized that this will not result in the creation of more wetland habitat; rather, it is the conversion of one valuable wetland habitat type into another. Habitat Equivalency Analysis (HEA) calculations of benefits from this conversion must **subtract** the value (biomass production) of mudflat habitats from eelgrass habitats in order to calculate the net benefit (see comments below).

The eelgrass restoration project focuses on dredging an area of mudflat. The dredging is certainly technically feasible. The ecosystem benefits cannot be assessed without more details, including the location of the project and the final contours, tidal creeks, etc. However, it is interesting that Duke does not mention eelgrass planting. Most eelgrass restoration projects involve active planting of eelgrass. Even with such active planting, some eelgrass restoration projects do not succeed. It is very difficult to predict the success of the proposed project, particularly in the absence of eelgrass planting and without information about depth and water quality, but I think there would be a significant risk that eelgrass will fail to become established or persist. This is important because the HEA calculations assume the presence of eelgrass. Furthermore, relying on natural revegetation by eelgrass may delay the development of the eelgrass bed, which should be reflected in the HEA calculations. Currently, Duke expects 100 percent service level in three years, which is too short a period for full development, particularly with natural revegetation.

SANDSPIT STABILIZATION

The specifics of this project (3 acres of eelgrass habitat reclaimed, $200,000 to $500,000 cost) appear to have little foundation in the project design. Duke admits (footnote 57, p. 83) that the cost will depend on acreage included and other design details, none of which are presently known. The basis for protecting 3 acres of eelgrass is equally uncertain. (In addition, the basis for the HEA calculations differs from statements in the main text.)

The success of this project is uncertain. Duke alludes to previous efforts, but these have failed. Duke does not report any similar projects that have succeeded.

HABITAT EQUIVALENCY ANALYSIS

Duke spends a good deal of time explaining the background to the Habitat Equivalency Analysis (HEA) and describing how it has been applied. They are correct in stating that HEA is used frequently by NOAA in natural resource damage assessments. However, there is a fundamental difference in how HEA is typically used by NOAA and its application by Duke. HEA is typically applied to habitat-based impacts, whereas the impacts ("debits") in Duke's application are simply biomass, with no habitat (i.e., area) basis. This complicates the HEA, and is *not* a standard application of the method.

Three assumptions underlying the HEA analysis are especially important for the final calculation: (1) the time before credits begin accruing, (2) the "ramp up" function describing how credits build from project initiation until the habitat reaches full productivity, and (3) the lifetime of the project. Duke presents their assumptions for each project in Appendix D, but the justifications for the particular values chosen are not adequate. This is especially true for the lifespan of each project. I believe a lifespan of 100 years is too long for these projects because we cannot reasonably predict what will be happening in Morro Bay and its watersheds 100 years into the future. Fifty years would be a more realistic project lifespan for these projects. (Even fifty years is a stretch. Think of the changes to Morro Bay, its watersheds, and relevant environmental regulations over the past 50 years; it would have been very difficult to predict in 1950 the events and activities affecting the Bay since then.) This is just one example of an assumption that is not adequately justified and is probably not appropriate. The same is true for the times assumed before projects begin accruing benefits and the ramp up functions. On balance, Duke's assumptions overstate the value of their projects, perhaps substantially. At the very least, Duke should perform a sensitivity analysis, showing how the range of assumptions affects the ultimate number of credits for each project.

The credits Duke calculates (e.g., Table 5 in Appendix D) are only appropriate for *habitat creation* projects. For projects converting one habitat type to another (such as mudflat converted to an eelgrass bed), one much subtract the productivity of the converted habitat from the final habitat. Duke does not do this. In fact, Duke assumes that mudflat habitats have trivial production. This is incorrect. First, although attached primary producers may have low biomass, Duke has not provided any data to demonstrate that their productivity is trivial. Second, primary production by attached primary producers should not be the sole source of production allowed. Infauna in mudflats harvest energy from the water column that is then transferred to fish biomass; this source of production is substantial and should not be ignored.

The estimates for primary productivity of different habitat types are not appropriate. Duke did not base their estimates on the most relevant studies. Productivity can vary tremendously from site to site, and only the most similar habitats should be used. For example, Table 2 of Appendix G lists primary production values for a wide range of salt marshes. The table includes *Spartina* marshes, which are fundamentally different from the pickleweed-dominated salt marshes found at Morro Bay. The most relevant data in Table 2 are for salt marshes between Tijuana Estuary and Mugu Lagoon in California, and only for mixed species or *Salicornia virginica* marshes. These values range from 100 to 1100 $g/m^2/yr$, with a mid-point of about 660 $g/m^2/yr$. (This was calculated as the

mean of the mid-points of each of the relevant studies in Table 2.) A careful review of these studies might lead to a better estimate, but as it is the value used by Duke is 14 percent higher than the value based on relevant studies. Duke's characterization of their estimate of 750 g/m^2/yr as "at the low to mid range for California marsh productivity" and therefore "a conservative estimate of productivity" is misleading. Duke does not distinguish between high and low marsh productivity, although this distinction is important for some of the restoration projects. Table 1 of Appendix G does not allow estimation of the relevant productivity values for eelgrass because locations similar to Morro Bay are not identified.

OTHER CONCERNS

FUNDING

I understand the appeal of setting funding obligations up front. However, there is a very real risk that a block of funding, determined before detail restoration plans have been developed, will not be adequate to fund the actual work required. It is commonly the case the unforeseen circumstances cause restoration projects to cost more than initially projected. The uncertainty in the actual funds needed for these projects is especially high given the very early stages of planning.
Duke asserts that they have doubled to restoration costs to provide an extra margin of safety. For example, on p. 40 they state that "Duke's experts have used conservative costing assumptions in determining the cost of implementing each of the representative projects. These costs were then doubled to build in a even larger contingency for unforeseen circumstances or difficulties encountered during project implementation." This statement is misleading. The "cost of implementing" the projects was for excavation or construction only, excluding the cost of planning, design, management, permitting, and so forth (e.g., pages 76, 77). These are real costs that must be part of the implementation of the projects, not "unforeseen circumstances." In spite of their assertions, Duke has not doubled implementation costs. The costs may be a realistic estimate of the projects as currently envisioned, but they do not include the substantial safety buffer Duke claims.

Duke has made other mistakes in describing project costs. For example, on p. 85 they describe the cost of the original Chorro Flats project as $10,000 per acre. This appears to be incorrect. The project consisted of 60 acres and cost $1 million, so the cost per acre was $17,000, not $10,000. (This does not include land acquisition costs; it's unclear how Duke handled these costs.) Therefore, the estimated construction costs range from $680,000 to $1.6 million. The higher end is much more likely to be realistic.

The staging of fund delivery means that a substantial amount of the funding will come a number of years after construction begins for the modernized plant. No accommodation is made for higher costs due to inflation and so forth. Perhaps the funds should be discounted as in the HEA.

CERTAINTY OF SUCCESS AND MONITORING

Duke's confidence in the success of their proposed restoration projects is not supported by past experiences with these sorts of projects. Certainly, well-designed and funded

restoration projects can provide substantial ecosystem benefits. But the literature is replete with examples of failed restoration projects, including projects that were thoughtfully planned and executed. The science of restoration ecology is young and there is much we do not know or cannot anticipate.

There have been a number of reviews of wetland restoration, including several conducted by the National Research Council (NRC 1992, 2001), and the universal recommendation is that project objectives be clearly stated, appropriate performance standards established, and project development *must be monitored* to determine if the performance standards have been met. Duke explicitly rejects this procedure (e.g., p. 34: "Duke does not believe nor intend that information from the proposed monitoring program can or should be used to determine the specific success or performance of the specific HEP projects."). Duke also argues that "restoration programs are more qualitative in nature, and produce ecological gains that may be difficult to measure in precise quantitative terms" (p. 22). This is not true and it ignores the advice of NRC committees and restoration scientists; it certainly is possible to measure ecological gains of restoration projects in quantitative terms.

In light of recent research in wetland restoration and the aforementioned studies, responsible restoration must include a monitoring program specifically designed to see if the restoration achieves its objectives. Duke leaves the project-specific monitoring to the Administering NGO or other project manager. Although the success of individual projects is important, there should be appropriate monitoring for the overall habitat enhancement program. The baseline monitoring proposed for Morro Bay is not adequate to assess the key aspects of the Bay related to larval losses and the effectiveness of the habitat enhancement program.

REFERENCES

Ambrose, R.F. and Meffert, D.J. (1999) Fish-assemblage dynamics in Malibu lagoon, a small, hydrologically altered estuary in southern California. *Wetlands* **19:** 327-340.

Craft, C.; Reader, J.; Sacco, J. N., and Broome, S. W. 1999. Twenty-five years of ecosystem development of constructed *Spartina alterniflora* (Loisel) marshes. Ecological Applications 9(4):1405-1419.

Desmond J.S., Zedler J.B. & Williams G.D. 2000. Fish use of tidal creek habitats in two southern California salt marshes. Ecological Engineering 14: 233-252.

Moy L.D. & Levin L.A. (1991) Are *Spartina* marshes a replaceable resource? A functional approach to evaluation of marsh creation efforts. *Estuaries* 14: 1-16

National Research Council (NRC) Committee on Restoration of Aquatic Ecosystems: Science T.a.P.P. 1992. *Restoration of Aquatic Ecosystems: Science, Technology, and Public Policy*. Washington, D.C., National Academy Press.

National Research Council (NRC) Committee on Mitigating Wetland Losses. 2001. *Compensating for wetland losses under the Clean Water Act*. National Academy of Sciences, Washington, D.C.

West J.M. & Zedler J.B. 2000. Marsh-Creek Connectivity: Fish Use of a Tidal Salt Marsh in Southern California . Estuaries 23: 699-710.

Williams G.D. & Zedler J.B. (1999) Fish assemblage composition in constructed and natural tidal marshes of San Diego Bay: relative influence of channel morphology and restoration history. Estuaries 22: 702-716

Zedler J.B. & Langis R. (1991) Comparisons of constructed and natural salt marshes of San Diego Bay. Restoration and Management Notes 9(1): 21-25

Zedler J.B. (1996) Coastal mitigation in southern California: the need for a regional restoration strategy. Ecological Applications 6(1): 84-93

Zedler J.B., Williams G.D. & Desmond J.S. (1997) Wetland mitigation: can fishes distinguish between natural and constructed wetlands. Fisheries 22: 26-28